DEVELOPMENT OF TECHNOLOGY OF PRODUCTION OF CERAMIC UNITS AND PARTS BY SELECTIVE LASER FUSION

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The development of highly efficient thermal protection is most acute in missile and aerospace applications in connection with the solution of problems of hypersonic flight with gas-jet control. One of the most effective materials are considered ceramic materials with low thermal conductivity and, in the first place, the oxide materials. However, ceramic parts usually have extremely low thermal resistance, making them unsuitable for operation in the conditions of thermal shock and thermal cycling.

Therefore, currently, a hypersonic aircraft to protect the metal parts from overheating and erosive effects of the environment, in particular in the gas-jet control system applied ceramic thermal barrier coating. This increase in requirements of the range leads to increased thermal loads on the elements of the modernized systems of the gas-jet control. In this regard, more stringent requirements for erosion resistance, strength and thermal insulation ability of ceramic materials to withstand cyclic thermal exposure of high intensity.

Increasing demands for range and intensity of maneuvering hypersonic vehicles at the moment is hampered by the complex dependent factors: weight, heat resistance and mechanical strength of structural materials at elevated temperatures. Existing to date technology of hot pressing and conventional sequential molding followed by sintering of ceramic materials, can not provide the required characteristics of the structural parts for hypersonic vehicles. This is especially true of hollow ceramic parts of cellular structure. Technology of production of ceramic components and parts by means of selective fusion, which refers to the additive technology will enable the engineering industry to solve complex materials science problems and to create a programmable structural material of cellular structure.

It should be noted that the analysis of modern trends of development of the relevant area of science and technology shows a rapidly growing segment of additive manufacturing refers to production technology of ceramic components and parts by means of selective fusing.

The result of the work performed will be established additive technology for manufacture of ceramic units and parts of the hypersonic aircraft of a new type by means of selective laser fusing of the modified ceramic powder materials with the use of innovative diagnostic methods that will increase not less than 30% of the thermal resistance of monolithic ceramic parts, and reduce the cost of production of parts and components of hypersonic vehicles is not less than 25 %, to reduce the time of manufacturing the parts and components of hypersonic vehicles is not less than 2 times.

The result of scientific research works on the program cipher 2016-14-579-0009-027 will be the transition to development work for the manufacture of ceramic units and parts of the hypersonic aircraft of a new type by means of selective laser fusing of the modified ceramic powder materials with the use of innovative methods of diagnostics in the interests of the military-industrial complex of the Russian Federation.